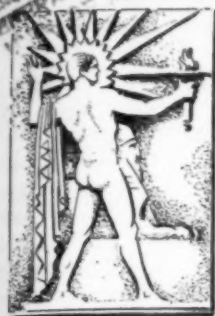


APR 16 1929



SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

A SCIENCE SERVICE PUBLICATION

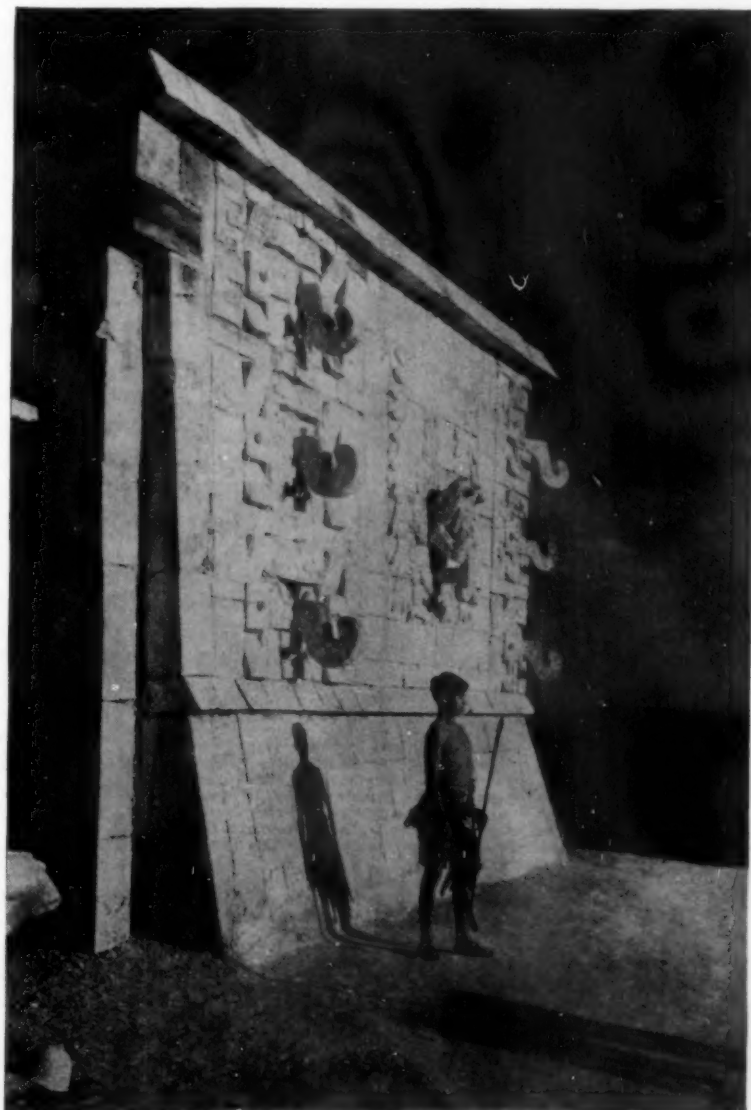


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April 13, 1929



THE TEMPLE GUARD

A Modern Maya Before the Temple of the Warriors

(See page 222)

Vol. XV

No. 418

10,000 Bee's Tongues Measured

Entomology

One of the first large scale measurements of insects, comparable to the elaborate measurements made by anthropologists of members of the human race, has been undertaken by Dr. W. W. Alpatov of the Zoological Museum of Moscow, now working at the Institute of Biological Research under Prof. Raymond Pearl of the Johns Hopkins University. Thousands of bees from Russia and the United States were examined during the investigation, which has shed interesting light on problems of bee-keeping, according to a report in the *Quarterly Review of Biology*.

The anatomical feature to which Dr. Alpatov devoted the most attention in this huge survey with the microscope was the tongue, tool of supreme importance in the business of honey collecting. In Russia it was found that bees' tongues increase in length as one travels south, until in the Caucasus, the southeasternmost

corner of European Russia, are found the longest-tongued bees now known to entomology. In the United States no such geographical distribution held good, a condition accounted for by the fact that all honey bees in this country are species introduced from Europe within the last two or three centuries. Furthermore, progressive beekeeping has fostered interbreeding with bees from all parts of the country. Racial characteristics cannot be as fixed as with indigenous bees bred in the same locality for hundreds of years.

Before the war the Caucasian bees were the subject of special investigation on the estates of one of the members of the royal family of Russia. The records left by the agronomist in charge show, said Dr. Alpatov, that crops of red clover, a plant that carries its nectar too deep down in the blossoms for most bees, were much heavier in fields where

there were hives of Caucasian bees than where they were absent.

Another point emphasized by Dr. Alpatov was the difference in tongue length of worker bees of different types but of the same race. Those collecting pollen, for instance, had shorter tongues than those collecting nectar. Slight as the present information on the subject is, he added, it shows "a promising possibility for systematic investigation of the selection and adaptation of the worker bees of different races to different plants. The preference of certain bee races for certain plants is the cause of differences in the quality of honey collected. It happens often that the color and flavor of the honey collected in the same locality by colonies belonging to different races differ greatly. This has naturally a certain importance from the point of view of marketing honey."

Science News-Letter, April 13, 1929

The Temple Guard

Archæology

The great stone Temple of the Warriors in the ruined city of Chichen Itza, in Yucatan, has been reclaimed from the jungle so far as science can accurately set the stones in place again, and it stands in cleancut beauty against the sky. The expedition from the Carnegie Institution of Washington, which spent much time and labor reconstructing the temple, is again at Chichen Itza and has sent the unusual photograph of one facade of the building, shown on our cover this week. Six grotesque masks with curling noses adorn the wall, and in the center is a carving of the Plumed Serpent, favorite deity of the city. The serpent clutches a human head in its jaws, and surrounding are the plumes in a graceful design. The carvings of the temple were originally painted in brilliant color. The native boy who stands guard before the temple of his ancestors is posed with spear and club. No doubt, temple guards were so armed in the thirteenth century, when the Warriors' Temple was one of the outstanding buildings of the city. The building was named because of the figures of eighty warriors that adorn the columns of the interior. Presumably, the figures are portraits of real statesmen and heroes of prehistoric America.

Science News-Letter, April 13, 1929

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

"Super-Universes" Located

Astronomy

By JAMES STOKLEY

From electrons up through the atoms they constitute, the various elements made up of atoms, the stars made of these elements, the star clusters consisting of swarms of stars, the "universes", such as our own, that are formed of hordes of the clusters, up to the "super-universes," or galaxies of galaxies, made up of a number of universes, and perhaps, to even more vast clouds made of these galaxies of galaxies, or "cosmons".

Such, in brief, is the overwhelming vista opened up to the scientist by the latest work of one of America's most famous astronomers, Dr. Harlow Shapley, the director of the Harvard College Observatory at Cambridge, Mass.

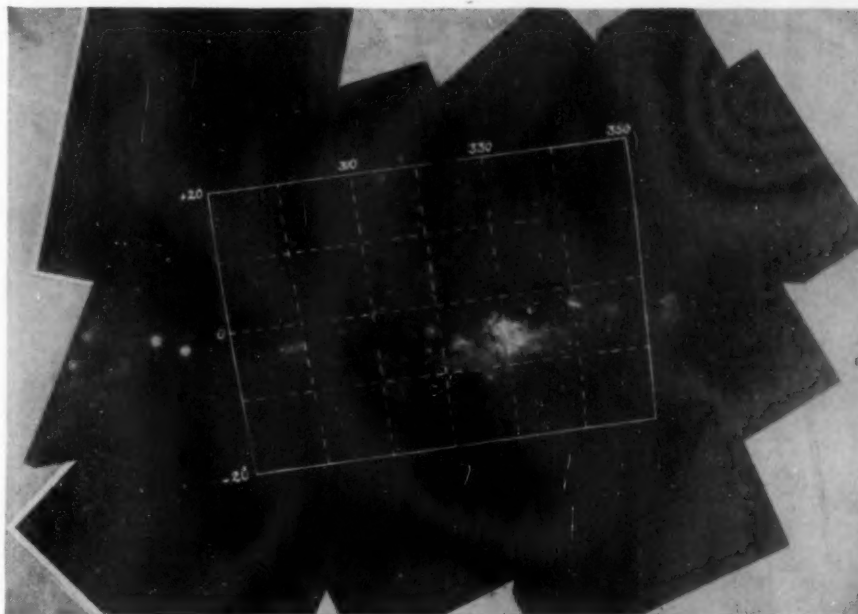
Though famous today, it hasn't been so many years since he was an unknown graduate student at Princeton. Here he studied under Prof. Henry Norris Russell, who also ranks among the leaders in any list of American astronomers. Dr. Shapley, having obtained his degree, went to Mt. Wilson in 1914, and began to attract favorable attention in astronomical circles.

Up to 1919, perhaps the best known name in American Astronomy was that of E. C. Pickering. He had been director of the Harvard Observatory since 1877 and had inaugurated countless important researches that had brought him international fame. In 1919 he died, at the age of 73. Speculation was then in order as to who should succeed him. When Dr. Shapley, 35 years old, was appointed in 1921, many astronomers probably wondered whether he could live up to the standards set by his predecessor.

That he could, and did, has been splendidly shown by the work that has been accomplished in the seven years of his tenure—work that has probably made the Harvard Observatory even better known today than it was when he took charge, while he himself ranks in the same class as his teachers.

His latest work has introduced us to a new order of sizes.

Since the time of the early Greeks, there have been theories that all matter was composed of smaller units called atoms. Somewhat over a century ago, the English chemist, Dalton, put the atomic theory on a sound



JUST AS AN AERIAL PHOTOGRAPHER makes a composite map of a great city by combining a number of overlapping photographs made from an airplane, so does the astronomer combine photographs to reveal larger areas of the sky than he can photograph at once. This composite picture, made at the Harvard Observatory, shows the center of our home galacton, as determined by Dr. Shapley. The numbers refer to galactic latitude and longitude. The center is at 0° latitude and 327° longitude, but happens to be hidden by a mass of dark matter.

basis. But then it was thought that the atoms were solid, round balls, incapable of change or division.

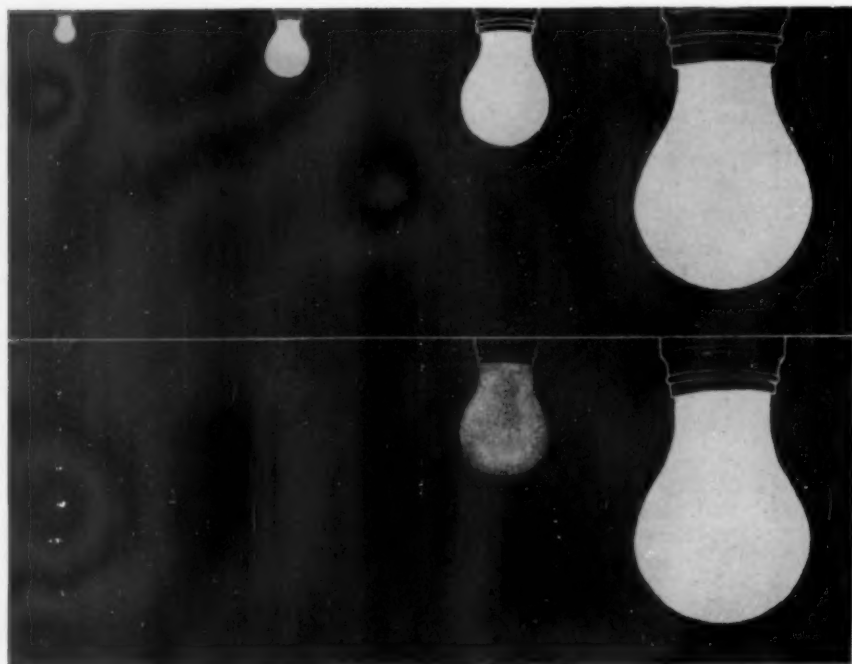
Then came the discovery of radium, and knowledge of the fact that its atoms are continually disintegrating into other atoms. This, as well as other discoveries, showed that the atoms were far more complex than Dalton had supposed, and so there arose theories of the structure of the atom, with the electron as the units of which the atom is constructed.

For hundreds of years it has been known that our earth is part of a family of planets that revolve around the sun, and that the sun is a star, appearing different from the rest of the stars only because we happen to be close to it. Contemporaneously with Dalton, another English scientist was making a name for himself. This was Sir William Herschel, famous astronomer. One of the things for which he is remembered today is that he showed the shape of the system of stars of which our sun, and all the other stars that we can see, is part. Its shape is that of a watch, or a grindstone, that is, round, but flattened. When one looks in the direction of the edge of the grind-

stone, the cloud of stars seems much thicker. This causes the appearance of the Milky Way.

However, while the shape of our system of stars, or "universe", has been known for over a century, it has only been very recently that the size has been definitely determined. It was a decade ago, while he was at Mt. Wilson, that Dr. Shapley gave astronomers a new idea of the size of this galaxy. He found that the globular star clusters, which are, as their name implies, spherical swarms of stars, form an outline of the entire galaxy. In them he found a peculiar kind of variable star, known as the Cepheid variable. Many stars change their light more or less regularly, but the peculiarity of the Cepheid is that it gets bright rapidly, then diminishes gradually. Thus it can always be recognized. Furthermore, its average brightness, or "candlepower", depends upon the speed at which the light changes take place. The faster the change is, the brighter is the star on the average. The Pole Star, ancient friend of mariners, is a Cepheid variable. Thus, when the astronomer sees a Cepheid and measures the length of time it takes for (Turn to next page)

"Super-Universes" Located—Continued



DR. SHAPLEY'S DIAGRAM showing how he proved the transparency of space. The upper half represents a row of frosted electric lights along a corridor, the farther away the lights, the smaller the image, but the surface brightness is the same. The more distant ones appear fainter because the area that they present to the eye is less. The lower half represents the same lamps when the corridor is filled with smoke or fog. The nearest lamp appears the same as before, but the more distant ones appear fainter as well as smaller. Study of the spiral nebulae, or galactons, showed that even the smallest and most distant have the same surface brightness as the nearer ones, so that there is apparently no cosmic fog between us and them.

one complete change of its light, he can measure its actual brightness, or candlepower. And then, if he measures the brightness that it seems to have, he knows that the difference is due to its distance, and so he can measure that. The case would be similar to that of a captain of a boat who judged his distance from land by the apparent brightness of a light on the shore. If he knew how bright the light actually was, he could estimate his distance.

So Dr. Shapley was able to measure the distance of the globular star clusters, and this gave an idea of the size of the galaxy. This turned out to be far greater than anyone had previously supposed—something more than 200,000 light years across. A light year—the distance that a beam of light will travel in a year—is equal to about 6,000,000,000,000 miles. The center of the galaxy, he found, is in the direction of the constellation of the Archer, and about 50,000 light years away. So, while we are not in the remote "sticks" of the galaxy, we do live in rather out-lying suburbs. In the last few years Dr. Shapley has performed further work which verifies this earlier result.

But our suburb does not stay put. It has been found within the last year or two that we are rather living on a merry-go-round. The galaxy is rotating. Since it is made up of separate units, and is not all of a solid piece, like the merry-go-round, the parts nearer the center turn faster. At our distance from the center it takes us about three hundred million years to make one trip around.

When Herschel made his observations with his great 48-inch telescope about 150 years ago, he was able to do more than show the shape of the galaxy. Another thing that he did was to study some of the star clusters and the nebulae. The star clusters, and what they are, have already been mentioned. To small telescopes, some of them appeared rather hazy, and it was not evident that they were made up of swarms of single stars. But with Herschel's telescope, the stars became apparent. So, when he looked at the nebulae, and saw that they looked much as the star clusters did with smaller telescopes, he concluded that they, too, were made of stars, and that still more powerful telescopic aid would resolve them.

Herschel was partly right. Some

of the nebulae, those with rather irregular shapes, finally proved to be clouds of glowing gases, but there were others, later recognized as having a characteristic spiral, or pin-wheel, shape, that still remained a puzzle. No telescopes were able to break them up into stars, that is, none could until 1919, when the 100 inch telescope of the Mt. Wilson Observatory, now to be dwarfed by one twice as large, was completed. With this great instrument Dr. Edwin Hubble, one of the Mt. Wilson astronomers, actually made photographs which revealed the stars of a couple of the nearer spirals. Further study, by Dr. Shapley, on the two Magellanic clouds, apparent in the southern sky and seeming like detached pieces of the Milky Way, showed that they too had some features in common with the spirals. A fifth object, very faint, and known only by a number, N. G. C. 6822, was similar. All consisted of swarms of stars, all were shown to be at vast distances, so vast that they are definitely outside our galaxy. In truth, they proved to be "island universes".

However, the term "island universe" is subject to some criticism. "Universe" is generally, and correctly, used to mean the entire cosmos, and to use the same name to designate merely a piece of it is rather misleading. So Dr. Shapley has suggested a new name for these galaxies that dot the sky by thousands and thousands—"galactons", similar to electrons, the smallest known units of matter. Such a name would be very useful, and deserves to come into wide use. Though only five galactons have been studied well enough so far to gain a very precise idea of their distance, many more will come into view of the new 200 inch telescope, and then our knowledge of them will be greatly extended.

Thus the scale of objects in the universe has been extended from electrons to atoms, from atoms to the elements, from the elements to the stars, from the stars to the galactons, and from the galactons to—what? Do the "island universes," the spiral nebulae, Magellanic clouds, and such group themselves together into any higher system?

It is to this question that Dr. Shapley, in some of his very latest work, answers, "Yes." There are such things as (Turn to next page)

"Super-Universes" Located—Continued

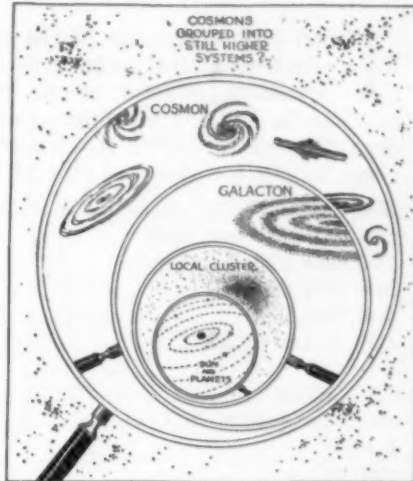
"universes of universes," galaxies of galaxies, but as these names are cumbersome he proposes that they be called "cosmons." So a cosmon may be defined as a cloud of galactons.

Nearly fifty separate cosmons have revealed themselves on the Harvard photographic plates, and the nearest is one in the constellations of Coma and Virgo, two adjacent groups that appear in the eastern sky in spring evenings. It is eleven million light years from us, it numbers 250 separate galactons, and is about two million light years across. Each of the galactons in it measures from five to twenty thousand light years in diameter, far smaller than our own system. All of the known galactons, whether part of a larger system or not, are much smaller than our own galaxy, except the Andromeda nebula. This is one of the two that Dr. Hubble measured, and it is only about a fifth as large as ours, or forty thousand light years in diameter. Furthermore our galaxy is apparently much more complex than any of the galactons that we see in the sky. What is the reason? One suggested by Dr. Shapley is that perhaps our galaxy was made from the condensation of a swarm of galaxies—a cosmon—into one vast system, unique in the sky, as far as we are aware at present. So perhaps that may be some small consolation for the dwellers on this insignificant earth, to know that our whole galaxy is the finest and best in the sky!

There is still another point about Dr. Shapley's latest researches which has an important bearing on the problem. All these measurements and estimates of distance assume that there is nothing between the things we are looking at and ourselves. But it is known that there are free electrons, dark clouds, and all sorts of things scattered around the sky that might get between us and act as a fog. A street lamp may appear faint because it is far away. Or again there may be a dense fog, and a lamp across the street may appear as faint as one three blocks away on a clear night. How can we tell whether space is clear, or full of fog?

This is the way he did it.

Imagine a long corridor. Along the ceiling is a row of electric lights, spaced, let us say, at ten foot intervals. The nearer ones look large and bright. Those farther away are



AN INFINITELY LARGE GIANT looking at the entire universe would find it made up of clusters of luminous objects—cosmons. If he looked at a cosmon through a magnifying glass, he would discover it to consist of galactons, "island universes." Applying his magnifying glass to a galacton, he would see a vast number of individual stars, and a more powerful glass applied to a part of a galacton would reveal the stars grouped into local clusters. And, finally, a look at a local star cluster through a glass magnifying a million million times, would show many "little" suns, some of them surrounded by a retinue of planets like the earth.

smaller and fainter. Those at the end of the corridor are barely seen as points of light, quite faint. Now measure their apparent size and apparent brightness, and make a curve representing this relationship. It will be found that the size and brightness fall off at the same rate.

But suppose the corridor is filled with smoke. The nearest lamp looks nearly as bright as it did before. Farther away, the smaller the lamps appear just as they did before. However, the brightness of the lamps now falls off much more rapidly than their apparent size, because the farther away they are, the more smoke their light has to pass through, and the more light is absorbed. The apparent size of the lamps is unaffected by the smoke.

Dr. Shapley and his associates have measured the apparent size of the galactons in relation to their brightness. Of course, they are not all exactly the same size, but in taking a large number of them, individual variations will be ironed out, because some will be larger than the average, and some smaller. He has found that their brightness falls off just as rapidly as their size, but no more so, and thus proves that the

space of the universe is not filled with some sort of cosmic smoke. The distances of objects far and near are entirely reliable.

Though it will be at least several years before the new 200 inch telescope in southern California is completed, already astronomers are beginning to think what they will be able to accomplish with it, and how far they will be able to see. Dr. Shapley's new researches remove one objection that might have been offered a few years ago, by people who thought that space might be foggy.

In fact, it has been suggested that with the new instrument astronomers will actually be able to see an appreciable fraction of all space!

It used to be thought that space was infinite—that if one started travelling in any direction, and kept on going forever, he would neither come to an end of space, nor retrace any of his former journey. Einstein, with his theory of relativity, has changed this view. Those who support his theory now hold that space is finite, but unbounded, which isn't quite as contradictory as it seems.

Imagine an ant on a globe. It can start in any direction and keep on going without ever coming to a boundary, but after it has made one circuit of the globe, it will be back where it started. Similarly, say the relativists, the universe is curved, in some higher dimension which we cannot comprehend. If we travel long enough, we will find ourselves back where we started from, or if we had a powerful enough searchlight, the beam of light would finally return and shine on our backs. Perhaps it would be better to say that it would shine on the backs of our remote descendants, for, in spite of the enormous speed of light, it would take about 520,000,000,000 years to return to its starting point!

In other words, the circumference of this curved space in which we live is somewhat over half a million million light years, and, if we can see that far, we can see all the way around. If a telescope will reach half as far, it will see all there is to be seen in the universe—assuming, of course, the validity of Einstein's ideas.

How near are we to accomplishing this?

Dr. Hubble, who penetrated deep-
er into space with (*Turn to next page*)

"Super-Universes" Located—Continued

the 100-inch telescope than did anyone before him, estimated that he could photograph galactons (only then he called them spiral nebulae) as far away as 140 million light years. With the 200-inch it will probably be possible to see for 500 million, or half a billion, light years.

Just what portion of the entire universe a sphere of half a billion light years will represent may be illustrated by radio reception on the earth. The circumference of the earth is about 25,000 miles. This will represent the entire universe. Scattered around the surface of our terrestrial globe are thousands of radio stations, just as the galactons are scattered around through space. If we have a set capable of hearing a station 12,500 miles distant, we can hear them in all places. But suppose that we have a set that will only bring in stations seven miles away—about as far as one can see on a level plain. That represents the 100 inch telescope, the best that the astronomical radio sets, called telescopes, that detect the tiny radio waves called light, can do at present. Now suppose that we are presented with a set that will tune in a station 25 miles away. Then we have the equivalent of a two hundred inch telescope.

Hearing stations 25 miles away as compared with a possible 12,500 miles seems pretty small, but at least it is an appreciable, though minute portion of the whole earth. So will the ability to see for half a billion light years enable us to see an appreciable portion of all of the universe. And just as radio research has brought all parts of the earth together, so will astronomers of the future be able to see farther and farther, until finally the entire universe is within hearing distance.

Science News-Letter, April 13, 1929

Recent examination of Chicago school children showed that 96 per cent. of the children had from one to fourteen bad teeth.

Knights of the Middle Ages were not always big fellows, judging by the size of some specimens of armor in museums.

A young Frenchman has given 117 pints of his blood in 264 blood transfusion operations.

THE following table of the dimensions of the universe, from the electron to the entire universe itself, was prepared by Dr. J. S. Plaskett, director of the Dominion Astrophysical Observatory at Victoria, B. C. Each figure represents a dimension 100 times larger than the one preceding it. On the right is a column of objects that come within the order of size of the figure given.

.000 000 000 000 06 inch	Electron
.000 000 000 006 inch	
.000 000 000 6 inch	Atom
.000 000 06 inch	
.000 006 inch	Soap bubble thickness
.000 6 inch	Tissue paper
.06 inch	
6.3 inches	Ordinary brick
.01 mile (633.6 inches)	Width of house
1 mile	
100 miles	New York to Philadelphia
10,000 miles	Diameter of earth
1,000,000 miles	40 times around the earth
100,000,000 miles	Distance earth to sun
10,000,000,000 miles	Diameter of solar system
1,000,000,000,000 miles	
17 light years,	
(100,000,000,000 miles)	Distance of nearer stars
1700 light years	Diameter of local cluster
170,000 light years	Diameter of galaxy
17,000,000 light years	Distance of nearer galactons or diameter of cosmon
1,700,000,000 light years	Six times range of 100-inch telescope
170,000,000,000 light years	Diameter of Einsteinian Universe



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Wesleyan University Gets Einstein MS.

Physics

The original manuscript of "Zur einheitlichen Feld-Theorie" in which Professor Albert Einstein recently gave to the world his newest theory, combining the laws of mechanics and the laws of electricity into one law and submitting a complicated mathematical proof of his theory, is now in the possession of Wesleyan University, Middletown, Connecticut, where it will be permanently kept and cared for in the Olin Library.

Dr. James L. McConaughy, President of Wesleyan University, told the story of the acquisition of the manuscript which he exhibited.

The document is in the strictest sense of the word a manuscript. It consists of eight pages of close-knit lines, all in Professor Einstein's handwriting, together with mathematical calculating and interlineations and all the customary features of a scholar's handwritten work.

Mathematicians will be interested in some portions of the manuscript which Professor Einstein crossed out.

The manuscript "Zur einheitlichen Feld-Theorie" was autographed by Professor Einstein at the bottom of the seventh page. The eighth page contains expressions of thanks to Professor Einstein's co-workers. Professor Einstein supplied his signature after arrangements had been made for the acquisition of the manuscript and he signed the seventh page because the scientific part of his manuscript ends there. These seven pages contain the results of six years of Professor Einstein's deepest thought.

It is said that Professor Einstein believes that it will be years before the world of science will be able to grasp fully all the details and implications of his theory and check up on his calculations.

The story of how Wesleyan University, at Middletown, came into ownership of the manuscript of "Zur einheitlichen Feld-Theorie" has many elements of human interest as Dr. McConaughy narrated it. The manuscript was obtained by Mr. George W. Davison, President of Central Union Trust Company of New York and Mr. Albert W. Johnston, financier, 111 Broadway, New York City. Mr. Davison is president of the Board of Trustees of Wesleyan University and Mr. Johnston has for years been an ac-

(7)

die Form an

$$(\frac{1}{2} \frac{d^2 \phi}{dt^2} + \frac{1}{2} \frac{d^2 \psi}{dt^2})_{10} = 0, \dots (99)$$

Aus diesen Gleichungen ist die Ableitung zu ziehen, dass das System (99) ein vollständiges System von 10 Gleichungen bildet.

Wären wir statt von (10) direkt von (99) ausgegangen, so hätten wir 10 elektromagnetischen Gleichungen (99) nicht erhalten. Auch würden auch kleinere Unhaltbarkeiten da sein, dass das System (99) und (10) miteinander verträglich sind. Es aber scheint es sicher zu sein, dass diese Gleichungen miteinander verträglich sind, da die Gleichungen (10) sich aus den Bedingungen für die Felder ableiten lassen. Zwischen diesen Gleichungen (10) und (99) besteht eine enge Beziehung, die es ermöglicht, die Gleichungen (10) zu eliminieren, so dass das System (99) allein ausreicht, um die Felder zu bestimmen.

Es ist zu bemerken, dass die Gleichungen (99) in erster Näherung die Gravitationsgleichungen enthalten, die die Gleichungen (10) in Verbindung mit der Existenz eines Potentials (10) die Maxwell'schen Gleichungen für das Vakuum, wie schon gesagt worden, zu bestimmten, zeigen können, dass umgekehrt die Gleichungen (99) die Gleichungen (10) enthält, wenn man die Gleichungen (10) für das elektrische Potential

$$\left. \begin{aligned} \frac{1}{2} \frac{d^2 \phi}{dt^2} - \frac{1}{2} \frac{d^2 \psi}{dt^2} &= 0 \\ (2 \frac{d^2 \phi}{dt^2} + \frac{d^2 \psi}{dt^2}) &= 0 \end{aligned} \right\} \dots (100)$$

Eine tiefere Untersuchung der Konsequenzen der Feldgleichungen (99), (10) wird zu zeigen haben, dass die Riemann-Metrik in Verbindung mit dem Fern-Parallelismus wirklich eine adäquate Auffassung der physikalischen Qualitäten des Raumes liefert. Nach dieser Untersuchung ist es nicht unwahrscheinlich, dass die Gleichungen (99) die Gleichungen (10) enthält.

Albert Einstein I 1929.

PAGE OF THE EINSTEIN MANUSCRIPT now in the Library of Connecticut Wesleyan University

tive Trustee of Wesleyan and is now Chairman of the Trustees' Committee on Buildings and Grounds, under whose direction and supervision the many buildings which have gone up on the Wesleyan Campus in recent years were erected. They have been friends since college days at Wesleyan; they are joint donors of the manuscript to Wesleyan.

Immediately after the publication of the new theory which Professor Einstein had promulgated, Mr. Davison instructed his Company's representative in Berlin to enter into negotiations with Professor Einstein to discover if the manuscript could be acquired. These negotiations were carried on with Mrs. Einstein, who surrounds Professor Einstein's life with the greatest protection. Professor Einstein has been in poor

health for a long time and his friends know that it has made him very happy to be able to complete the development and statement of his new theory in spite of the condition of his health and the strain of the arduous mental toil which the work has involved. The astonishing feature of the story of the way in which Professor Einstein's manuscript came to make its journey to the United States is the ease with which its acquisition was accomplished.

Professor Einstein is an ardent Zionist and the manuscript of his relativity theory was sent to the Zionist University in Jerusalem. The manuscripts of Professor Einstein's works between the publication of his relativity theory and the publication of "Zur einheitlichen Feld-Theorie" were (Turn to next page)

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Einstein MS.—Continued

purchased by Baron Rothschild of London, who presented them to the Einstein Institute in Berlin. When Mr. Davison's negotiations for the new manuscript were opened no other approach had been made to Professor Einstein with a view to its purchase, and through Mrs. Einstein ready assent was given by Professor Einstein to the sale of the manuscript to Mr. Davison, whose representative explained that it would be permanently entrusted to the custody of an American university. The only interest which Professor Einstein had in the financial aspects of the transaction was that its sale should realize sufficient money to enable him and his wife to carry on the welfare work among university students in which both of them have long been much interested. The price which Professor and Mrs. Einstein regarded as satisfactory had no relation to the pricelessness with which in time the manuscript itself will assuredly come to be held. It is understood that Connecticut Wesleyan will have the only original Einstein manuscript in this country.

In speaking about the manuscript, Dr. McConaughy said: "Wesleyan University feels itself honored to be entrusted with this extraordinary document. I use the word entrusted advisedly because Wesleyan will always consider that as custodian of this precious manuscript it has a trusteeship of it in the interests of the whole world of scientific thought. It is probable that photostat copies of this manuscript will be made available by Wesleyan for every university and college which desires to possess such a copy. The manuscript itself will be most zealously safeguarded."

Science News-Letter, April 13, 1929

Do You Know That

Alaska has a herd of galyaks, which are hybrids of galloway cattle and the Tibetan yak.

The Leviathan recently set a new speed record for ocean liners by going 27.8 knots an hour which is 36.4 land miles.

An experiment on the improvement of illegible handwriting among school children showed that drill work on specific defects was more effective than general drill on penmanship.

Planes Make Pastures

Aviation

Airplanes are making the desert blossom, if not exactly as the rose, at least as first-class pasture land, in large areas of cutover timber land in the Pacific Northwest. They have added to their already long list of accomplishments the role of broadcast sowers of grass seed, and the first experiments have shown them to be much more successful and rapid than hand workers, as well as more economical.

Timber companies in the Northwest have found the problem of the large areas of stripped lands on their hands left after logging operations a serious one. The most economical use appears to be to burn the "slash" and then sow them in grass and use them as sheep or cattle pasture. But the land is for the most part very broken and rough, and men on foot have a hard time seeding it. This method proved to be so slow and expensive that it has been employed only where conditions were ideal.

One corporation hired a plane and pilot for a commercial flying company. It had a special hopper built for releasing the grass seed, which was spread out in a wide stream by the propeller blast. Flying fairly low across the newly burned-over land, the plane sowed the grass seed into the loose ashes, which served as a receptive and well fertilized seed bed.

One plane was able to sow from 150 to 200 acres of rough land a day. The best that a man on foot can do over similar terrain is five to eight acres a day. Even counting the high cost of plane hire or ownership, the flying method of sowing is by far the cheaper, averaging 40 to 60 cents an acre, as against a cost for hand sowing of 75 cents to \$1.25 per acre. Moreover, plane sowing requires only six or eight pounds of seed per acre, while the hand method uses ten or twelve. Since grass seed costs from 30 to 35 cents a pound wholesale, this item is not inconsiderable.

The work of sowing over broken ground is not without its dangers. The planes have to fly fairly close to the ground, and the broken surface and frequent deep side ravines cause all sorts of treacherous air currents. The aviator has to be constantly on the alert, for a forced landing would almost certainly mean a crash. However, all the work to date has been accomplished without accident.

Science News-Letter, April 13, 1929

Fire Enemy of Oil Production

Engineering

Many of the devices used in modern warfare are now employed in American oil fields to fight that deadliest of enemies, fires. Earthworks are thrown up, trenches dug, barricades erected, sappers put to work tunneling, airplane propellers used to divert the intense heat from the workers and gas masks and protective clothing quickly brought into use. It is expensive, but less costly than to let thousands of barrels of oil and millions of cubic feet of gas burn to waste and endanger surrounding property.

Every precaution is taken to prevent oil field fires. Smoking is prohibited; flame is kept from the vicinity of the wells; but there is an ever-present danger of fire from static electricity caused by the friction of steel tools and cables, from lightning, carelessness and from other sources. Ordinary fire preventing and fighting methods are not suffi-

cient. Water has no effect on burning oil and gas, especially when the flames rise high in the air like a gigantic blow torch and radiate heat so intense that a camera lens cracks even when photographers endeavor to take a picture of the spectacle from vantage ground a hundred or more feet away.

Two gushers which were ignited in the Santa Fe Springs oil field, one of the most prolific in the world, burned with such heat that more than a week passed before men garbed in asbestos and constantly sprinkled with water could clear the ground within working distance of the flames. More than a month went by before the flow of oil and gas could be shut off and the blaze thus starved.

The flames quickly melted to wreckage the steel derricks above them and burned to charcoal nearby wood structures. (Turn to next page)

Greeks Wore Silk

Archæology

Were the clinging sculptured draperies of the Parthenon Fates made of silk? Were the diaphanous and alluring feminine garments described in Aristophanes' comedies of the same sheer silkiness that arouses diatribes from the pulpits of today? Though silk is not supposed to have been known to the Greeks until the fifth century A. D., Gisela M. A. Richter, of the Metropolitan Museum of Art, is inclined to think that the much-suppressed females of classic Greece knew silk and its beautifying advantages and transparencies long before.

Linen and wool were the common fabrics worn on that luminous peninsula but classical literature contains many references to thin, highly expensive garments called Amorgian tunics. Miss Richter declared recently in a report to the Archæological Institute of America. They are thought to have been made of especially fine linen from the island of Amorgos, a rocky bit of land in the Aegean with, however, only a few tiny valleys fertile enough for the cultivation of flax; hardly enough, according to Miss Richter, to support an important industry of even a high priced article.

Supporting her theory by research among ancient Greek and Latin writers she has established an hypothesis that the (Turn to next page)

Hearing Helps in Maze

Psychology

Soundproof material used on the floor of a maze has revealed to investigators, after many years of experiments, a secret by which rats successfully learned the only correct route through the long series of complicated passages of a maze to the single exit.

Dr. John F. Shepard, professor of psychology at the University of Michigan, read a paper before the Michigan Academy of Science, Arts and Letters, stating that rats which had previously learned the maze perfectly seemed utterly lost when the sound of their pattering feet on the floor of the maze was stilled by soundproof layers.

Lengthy experiments indicated that the rats were not finding their way out of the maze by their senses of sight, smell, muscular feeling, or touch. Finally, it was discovered that changing the position of the squares of asphaltic linoleum which covered the floor of the maze caused the animals to be less certain of the direction to take in finding their way. Soundproof floors were installed, and these prevented the rats from learning the route.

Experiments now in progress will determine whether the rats depend solely on their sense of hearing for guiding themselves out of a maze. Since rats are widely used by psychologists in studying such processes (Turn to next page)

Conquering Oil Fires—Continued

Others were razed to prevent the spread of the fire. Forty strings of tools and their crews were forced to suspend work in the danger zone, while more than a hundred men turned their attention from production of oil to fire fighting.

A double offensive against the fire was begun. An earth barricade topped by a metal shield was built some distance from the flame and two airplane motors equipped with propellers started in front of it to divert the heat so that workmen might dig a 210 foot tunnel to reach the well casing 50 feet below the surface. Working night and day, they excavated and shored the tunnel, then dug a chamber about the well casing preparatory to tapping it and leading the oil and gas into pipes they laid as they tunnelled.

Meanwhile, on the surface, men garbed in asbestos kept wet by fire-

hose and fanned by the airstream of the propellers, crept to the foot of the blaze and repeatedly attempted to install a "Christmas tree", or pipe and valve mechanism which would enable them to shut off the flow of fuel. They faced sudden death from flame or explosion every minute they were at work, especially when the time came to operate the shut-off valves and the danger was enhanced by the fact that the fire, rather than submit to extinction by starvation of its oil and gas fuel supply or of the supporting oxygen, might blow back or shoot out through the joints. Success finally attended their efforts, however, and they extinguished the blaze just before their fellow-workers had completed connections far underground. Man thus has learned to conquer an inferno, but the cost in life, time and money is great.

Science News-Letter, April 13, 1929

Hearing Helps—Cont'd

as learning and memory, a thorough understanding of animal reactions is particularly useful to laboratory workers.

Science News-Letter, April 13, 1929

Greeks in Silk—Cont'd

havoc-creating Amorgian tunics were made of wild silk introduced from the East, where it was known from the earliest times. The name Amorgian (a specific word for silk appears in Greek only after the Roman era) she accounts for by the fact that the island was a convenient station on the trade route from the East via the Persian Gulf, Babylon and Tyre. It is the next door neighbor of the island of Cos, which by the time of Aristotle was considered the home of Greek silk manufacture, so what was more natural, Miss Richter concludes, "than to call these silk garments Amorgian, just as later the Roman called them 'Coea vestes'." To call a material after a place from which it is supplied is, of course, a well known practice."

The Greeks may also, she added, have learned about silk from their near neighbors and frequent enemies, the Persians, who are known to have been addicted to luxurious silken apparel as early as the fifth century B. C.

Science News-Letter, April 13, 1929

Recently perfected apparatus enables doctors to make a continuous record of the effects of exercise or medicine or disease on a patient's heart.

A German report states that suicide among women of Prussia has increased 157 per cent., whereas male suicides have increased only 29 per cent.

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"First Robin" Usually Winter Boarder

Ornithology

The robin, so generally considered the harbinger of spring by folk in the northern states, really does not mind zero weather at all as long as he is well fed. The "first robin" reported early in the spring, really may be a bird that never was more than a dozen miles away during the coldest of the cold waves.

Norman A. Wood, veteran curator of birds at the University of Michigan museum, has records dating back to 1880, in which there is entry after entry of red-breasts being seen on New Year's day, within 20 miles of the University, and with the thermometer down around the zero mark. The availability of food, not the rigors of low temperature, largely determine the extent of the southern

migration of robins, he explains.

His records indicate that a flock of several hundred robins wintered in the vicinity of one of southern Michigan's small lakes during 1912, with temperatures of from 14 to 20 below zero being recorded for January and February. The following New Year's day, 40 were counted in one flock. Unpicked berry patches nearby provided food.

Such patches, or apple orchards in which the fruit has been left to rot on the tree limbs in the fall, supply the birds well until March brings a thaw, he said. Insectivorous birds, on the other hand, cannot sustain themselves when ice and snow cover the ground and therefore invariably fly south, or perish.

Science News-Letter, April 13, 1929

Squirrels Swim Mississippi

Zoology

The old cowboy boast, "I've swum the Mississippi and I've clumb the Great Divide" is made good by such small animals as squirrels, according to Superintendent W. T. Cox, of the Upper Mississippi Refuge.

Many animals swim the Mississippi River from bank to bank, undoubtedly doing it of their own free will. Gray squirrels, fox squirrels, and red or pine squirrels are among the animals most frequently found boldly essaying to cross from the Wisconsin or Illinois bank to the distant Minnesota or Iowa shore.

Hundreds of the squirrels are seen struggling through the swift, muddy current. For the first few hundred yards after taking to the water these animals keep their bushy tails sticking straight up as if to keep them dry. Later, as the animals become wearied, their tails dragging in the water make progress slow and steering difficult.

An interesting feature of the squirrel migration is that the animals in nearly every case seem to have a destination in view. When allowed to crawl up an oar into a boat, as they are perfectly willing to do, they will ride along if the boat is going in a direction that suits them, but if not, they will soon jump out and resume swimming. Woodchucks, raccoons, skunks, and other animals not ordinarily seen in the water occasionally strike out boldly and swim the Mississippi.

Science News-Letter, April 13, 1929

Stone Age Grasshopper

Archaeology

One of the oldest representations of an insect in art has come to light in the archaeologically famous cave of the Three Brothers in the commune of Montesquieu-Avantes. It is a grasshopper crudely carved out of a bit of ancient bison bone now in the possession of Comte Begouen, father of the three youths who first discovered the cave of prehistoric wonders, and for whom it is named.

It is the first time that an insect of this type has been found in the art of the Old Stone Age, according to Comte Begouen, and presents a considerable puzzle to archaeologists to explain, since such insects were rare in the cold climate that prevailed in France in the Magdalenian epoch when the carving was probably made.

Science News-Letter, April 13, 1929

Fossil Pearls Found

Paleontology

Ten pearl-like fossils found by geologists of the University of California in rocks laid down about 25,000,000 years ago have proved under test to be real pearls, conforming in structure with the modern variety, and having as their source molluscs related to the present pearl oyster.

The pearls were uncovered while the University men were searching for fossils of the Cretaceous period near Redding, Calif. In spite of their 25,000,000 year burial from the time when dinosaurs were making their last stand on earth, the pearls still maintain a little of their luster.

Science News-Letter, April 13, 1929

NATURE RAMBLINGS

By FRANK THONE

Natural History



Earliest Flowers

This is the season of catkin-blossoming trees. There are still a few pussy-willows to be found, the birches are trailing their long, caterpillar-like flower-clusters, and the first really warm day brings a shower of "red neckties" from all the gentry of the cottonwood groves.

Botanists reckon trees that bear their flowers in long, pendulous clusters after this fashion as the primitives of the woody plant world. A catkin is about the simplest assemblage of flowers that one can well imagine. There are no bright petals, no green sepals; only the bare necessities of pollen-producing or seed-bearing structures, strung irregularly or in a spiral along the central stem or axis.

Some of the catkin-bearing trees have only male, or pollen-producing, flowers on one individual; and only female, or pistillate flowers, that eventually bring forth the seed, on another. This is the case with the willows and poplars, and explains why some cottonwoods do not "shed cotton", but instead litter up the lawn and walks with "red neckties" or "caterpillars". In other species, like the birches, male and female catkins are borne on the same tree, but only the male flower-clusters are conspicuously trailing objects. The female catkins show up very little in the spring, and have their innings later on, when the seeds are ripe. Then they shed their hard little green scales in showers like a kind of summer snow.

The catkin-bearers, though primitive, are none the less important members of the tree world, for they include, among others, walnuts, oaks, beeches, willows, birches, chestnuts, ironwoods and hazel bushes.

Hepatica

In the warmer spots among the still naked bushes (Turn to next page)

Nature Ramblings—Cont'd



there may be found shining pure white flakes of bloom, one of the earliest of spring flowers. Hepatica does not always wait for all of winter's snow to melt. Spring may be in full glow in a sunny spot, while a few feet away a remnant of the earth's discarded snow blanket may lie forgotten and neglected.

The hepatica, indeed, is a hardy little plant in any case, for its last year's leaves endure through the winter, and the new spring's crop of foliage does not develop until after the blossoms are gone.

The name "hepatica" dates back to the peculiar practice in ancient medicine of treating diseases with plants that bore real or fancied resemblances to the afflicted organs. The three-parted leaves of the hepatica looked to the old Greek and Roman physicians like little three-lobed livers; so the plant received its name, which is from the Greek word meaning "liver". A second English name by which the plant is known is a straight translation of its more usual half-Greek one: "liver-leaf".

Science News-Letter, April 13, 1929

The Eternal Present

Philosophy

MAURICE MAETERLINCK in *The Life of Space*, translated by Bernard Miall (Dodd, Mead):

We cannot imagine time save with reference to ourselves; and this is, indeed, the proof that it does not exist in itself; that it is always relative to the person who has the notion of time; that there is no absolute past or future, but everywhere and always an eternal present. In reality, it is not the events that approach or recede; it is we who pass them by. An incident does not approach us; it does not move; it has never moved; it lies hidden in the today which has neither beginning nor end; it is we who go towards it.

It is thus that we cast a furtive glance into a world of four dimensions, in which before, after and now are superimposed, piled upon one another like photographic films and co-existing from all eternity.

Science News-Letter, April 13, 1929

TUNE IN on Science Service's Radio Talks

Every week a radio talk on science, prepared by Science Service, is given from each of the stations listed below at the times mentioned. Times are in standard time of the locality.

- KFMX NORTHFIELD, MINN.; Carleton College; 1250 kc., 1000 watts. Monday, 11:00 to 11:15 a. m.
- KGBU KETCHIKAN, ALASKA; Alaska Radio and Service Co.; 900 kc., 500 watts. Wednesday or Friday, 7:00 to 7:15 p. m.
- KGU HONOLULU, T. H.; The Honolulu Advertiser; 940 kc., 500 watts. Irregular times.
- KGW PORTLAND, OREGON; The Portland Oregonian; 610 kc., 1000 watts. Sunday, 5:00 to 5:15 p. m.
- KOAC CORVALLIS, OREGON; Oregon State Agricultural College; 560 kc., 1000 watts. Friday, 7:30 to 7:45 p. m.
- KUOA FAYETTEVILLE, ARKANSAS; Roy E. Burton; 1390 kc., 1000 watts. Monday, 8:30 to 8:45 p. m.
- WCAD CANTON, N. Y.; St. Lawrence University; 1220 kc., 500 watts. Tuesday, 12:30 to 12:45 p. m.
- WCAJ LINCOLN, NEBRASKA; Nebraska Wesleyan University; 590 kc., 500 watts. Friday, 4:30 to 4:45 p. m.
- WDAE TAMPA, FLORIDA; Tampa Daily News; 620 kc., 1000 watts. Irregular times.
- WEAO COLUMBUS, OHIO; Ohio State University; 550 kc., 750 watts. Friday, 12:50 to 1:05 p. m.
- WGR BUFFALO, N. Y.; W G R, Inc.; 550 kc., 1000 watts. Thursday, 6:15 to 6:30 p. m.
- WHAS LOUISVILLE, KENTUCKY; Courier-Journal and Louisville Times; 820 kc., 6,500 watts. Tuesday, 10:00 to 10:15 a. m.
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- WSM NASHVILLE, TENNESSEE; National Life and Accident Insurance Co.; 650 kc., 5000 watts. Wednesday, 5:45 to 6:00 p. m.
- WWVA WHEELING, WEST VIRGINIA; West Virginia Broadcasting Corp.; 1160 kc., 250 watts. Thursday, 6:00 to 6:15 p. m.

If none of these stations are within reach of your radio set, write to the Program Director of your favorite radio station, suggesting that he add Science Service's radio talks on "Science News of the Week" to his schedule. Full information from

SCIENCE SERVICE
2101 B Street Washington, D. C.

Eleven New Pneumonia Types

Bacteriology

Eleven types of pneumonia not hitherto recognized as due to distinct forms of pneumococci, the pneumonia germ, have been discovered by Georgia Cooper, bacteriologist in the research laboratories of the New York City Department of Health, Dr. William H. Park, Director of Laboratories, has announced.

Dr. Park also said that specific antibacterial serums have been developed for the most usual five of these new types, although sufficient experience with them has not yet been obtained to affirm positively the apparently good results from their use in a limited number of cases.

The remaining six types, he said, constitute about three per cent. of all cases studied. Thus type III is the only important form of the disease which remains apparently resistant to antipneumococcic serum.

"Serums which greatly improve the chances of a patient, especially when given early in cases in which the blood stream is becoming infected with pneumococci, have been developed for type I and type II," explained Dr. Park.

"While we are working continuously to find a serum that will be effective in type III cases, we have not yet succeeded. In the past we have classed cases which did not fall into type I, II or III in a miscellaneous group known as group IV. We have known for some time that this group contained other distinct types which had not been classified, but it remained for Miss Cooper to classify eleven of the most important of this miscellaneous group. Those which we cannot classify are now known as group XV.

"Dr. Antoinette Raia, who has conducted research in connection with children at Bellevue Hospital, has made preliminary reports which indicate the value of serum in types IV, V, VI, VII, and VIII. Her work also indicates that these types are more usual with children than adults."

Polyvalent serum, or serum effective in both type I and II, has been prepared for the New York City Health Department for distribution for some time, but the attempt is now being made to prepare serum which will be effective as well for types IV, V, VI, VII and VIII. Dr.

Park advises the administration of polyvalent serum at once when the clinical diagnosis indicates pneumonia.

When laboratory facilities are available, the case can be typed quickly and future administration of serum of the type indicated can be specific. Highly concentrated serum which produces only in rare instances the unfavorable effects of large doses of horse serum is now available.

While the development of anti-pneumococci serum has not yet reached the stage where the results are so certain that there is any hope of virtually suppressing the disease, as has been done with smallpox, and as health authorities are now attempting to do with diphtheria, it is well past the stage of being of doubtful benefit, Dr. Park said.

Many more cases of pneumonia might now be saved, he declared, if facilities for preparing the serum were adequate for the fullest usage, and if the medical profession were fully informed of the progress which has been made in the past year or two.

Science News-Letter, April 13, 1929

Goldfish Fed on Alcohol

Physiology

Oh, for the life of a goldfish in a scientist's laboratory! No grape juice for him when he is feeling low. Alcohol and sugar is the enviable diet fed for thirty hours to goldfish in the laboratory of some University of Illinois scientists.

And the scientists proved by actual measurements that the gold fish lived at a greater rate than their brothers who had sugar alone. At least, the process by which the goldfish turned sugar into body energy and heat was on a speedier level, judging from the much greater amount of sugar they used in the thirty hour period, compared with their dry brothers who dieted on sugar exclusively.

The experiment proved that alcohol can serve as food as well as quench a thirst, according to a report made to *Science*. It has been known for some time that alcohol served one function of foods, that of being oxidized in the body to give rise to heat and energy. The goldfish experiment, carried out by Prof. W. E. Burge, L. D. Seager and D. J. Verda of the department of physiology

of the University of Illinois, proved that alcohol also can perform another function of foods, that of increasing or stimulating the body's conversion of food into heat and energy. This process by which the body turns food into heat and energy is called metabolism. In scientific terms, what the alcohol does is stimulate the sugar metabolism of the body.

Fats and proteins are also capable of stimulating or increasing metabolism. Alcohol is almost as good as fat and protein, the goldfish experiment showed.

Science News-Letter, April 13, 1929

Beaver Planting Successful

Zoology

The attempts recently made to stock the upper Mississippi River Wild Life and Fish Refuge with beaver colonies are beginning to show good results. Superintendent W. T. Cox in a recent report states that the beavers captured in northern Wisconsin last spring and liberated on the flats near Wabasha, Minnesota, are apparently doing well.

Science News-Letter, April 13, 1929

Antiseptic Milk

Hygiene

Scientists have known for some time that babies fed on mother's milk were protected in some mysterious fashion from various diseases such as whooping cough, measles, diphtheria and the like.

Now it appears that the mother's milk actually has the power of killing disease germs. Dr. Friedrich Schlaeppi, bacteriologist, has experimented with milk from nursing mothers and found that the milk has this bactericidal power to a very high degree. If the milk is kept at a mean temperature this power may be demonstrated for sixty hours or more. Such bacteria as get into it are at least very much retarded in their development if not actually killed. The milk is even able to destroy bacteria which do not normally occur in it. Boiled milk has not this power. The boiling destroys the milk's germicidal properties.

Dr. Schlaeppi has succeeded in filtering milk, obtaining a clear greenish liquid which contained albumin but no fat. The germs naturally contained in the milk stayed back with the fat, but the power to kill bacteria remained in the clear filtrate.

Science News-Letter, April 13, 1929

How Spiders Hear

Zoology

T. H. SAVORY, in *The Biology of Spiders* (Macmillan):

The problem of the spider's ability to hear is more difficult than that of any other sense, and, since it is connected with the sense of touch, may be considered here.

Very simple experiments with spiders hanging in their webs seem to make it quite evident that they can hear, for they respond to all sorts of sounds by shooting out their fore-legs as if reaching towards the origin of the sound. If the first pair of legs are missing, the second pair are held out in the same way, and this response can be elicited by a whistle, a cry, a sounding tuning-fork, a cough or the bark of a dog.

When we recall the many stories which have been told in illustration of the spider's apparent love of music; how they have emerged from their hiding-places at the notes of a violin; how they have come each night to sit upon a harmonium as often as it was played, and so on, there seems to be good enough reason for believing in their power to hear.

The subject must, however, be considered more fully, more experimentally. In the first place, the spider's reaction to sound is a very curious one, evoked in no other way and quite useless to the spider. If a spider, or any other animal, can hear in the same way as we can, it must be able to interpret the sensation received and to react in an appropriate way. This the spider does not do; its response is valueless.

Moreover, the response is not constant, even within the limits of the same family. The common *Epeira* responds when adult in the way described above, but young individuals of the same species generally drop from their webs at the end of a thread.

Spiders of the closely related genera *Meta* and *Cyclosa*, belonging to this same family, usually drop too in the same way, but *Zilla* scrambles home to its retreat along the free radius, which characterises its web, as quickly as possible.

When we extend our tests to spiders of other families we find contradictory results. All kinds of hunting spiders are apparently deaf and cannot be made to respond either to tuning-forks or to singing grasshoppers. A negative result of this kind can never be quite satisfactory, especial-

ly when dealing with spiders, for spiders show on occasions a stoical indifference to disturbances which do not interest or appeal to them. For example, sometimes a well-fed house-spider will not only pay no attention to a fly kicking about in the web, but will allow the fly to walk up to her, touch her, and even crawl over her without making any movement. The fact, then, that the spider "takes no notice" is not a definite proof that it does not hear, and we must fall back on other tests.

Where, for instance, are the spider's ears? From what has been said above, it will be obvious that the setae will be first suggested, and in 1883 Dr. F. Dahl found that some of them could be made to vibrate in response to the notes of a violin. These setae gained the name of Hörhaare from that date, and the fact that they are sometimes arranged in a graded series made it at least possible that setae of different lengths respond to notes of different pitch. But even so the auditory capabilities of these setae is not proved, and Wagner, in 1888, failing to verify Dahl's results, took exactly the reverse view and insisted that the auditory hairs were only able to perceive sensations of touch. McCook's view, too, was that the sense of hearing is very rudimentary and not really distinguishable from that of touch.

We are thus led to consider the hypothesis that the delicacy of the spider's tactile sense enables it to feel the vibrations of the air which constitute sounds, in somewhat the same way as a deaf person can "hear" the Bourdon stop of an organ. It is possible that its response is a mechanical effect—exactly, in fact, what is implied by the term Barrows suggested in 1915—a positive vibrotaxis.

Science News-Letter, April 13, 1929

A Wonderful Bird

Ornithology

E. G. BOULENGER, in *Animal Mysteries* (Macaulay):

In the pelican we have a wonderful example of the manner Nature can combine not only the harpoon and rope, but also the landing net, up to 40 pounds of fish being occasionally held in the bird's enormous membranous throat-pouch before being transferred to its interior.

Ornithology

Science News-Letter, April 13, 1929

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

OF SCIENCE NEWS-LETTER published weekly at Baltimore, Md., for April 1, 1929.
District of Columbia
Washington City

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edwin E. Slosson, who, having been duly sworn according to law, deposes and says that he is the Publisher of the SCIENCE NEWS-LETTER and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Edwin E. Slosson, 21st and B Sts., N. W., Washington, D. C.

Editor, Watson Davis, 21st and B Sts., N. W., Washington, D. C.

Managing Editor, Watson Davis, 21st and B Sts., N. W., Washington, D. C.

Business Manager, Watson Davis, 21st and B Sts., N. W., Washington, D. C.

2. That the owner is:

Science Service, Inc., 21st and B Sts., N. W., Washington, D. C., a non-profit making corporation and scientific institution.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Edwin E. Slosson,
Publisher.

Sworn to and subscribed before me this 25th day of March, 1929.

[SEAL]

(My commission expires April 6, 1933.)
Charles E. Wade.

There is an ever increasing number of human beings who do not develop an appetite, even when undernourished, a well-known physiologist declares.

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SCIENCE SERVICE, Book Dept.,
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Washington, D. C.

FIRST GLANCES AT NEW BOOKS

THE BIOCHEMISTRY OF THE AMINO ACIDS—H. H. Mitchell and T. S. Hamilton—*The Chemical Catalog Co.* (\$9.50). The monographs of the American Chemical Society are invaluable in summing up all recent researches in a given field and presenting a view of the present status of the subject, a service that is continually becoming more essential as chemical literature becomes more voluminous and unwieldy. The amino acids is a particularly difficult subject to master and yet particularly important because of its practical bearing on medicine, on dietetics and on plant and animal physiology. The authors handle their mass of material with competency and discuss the hotly contended questions with fairness and firmness.

Chemistry

Science News-Letter, April 13, 1929

EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1928—*Smithsonian Inst.* A report compiled from the notes of various members of the Institution staff. There is much of the romantic, as well as much of the laborious, recorded in volumes such as this.

General Science

Science News-Letter, April 13, 1929

THE WITCHERY OF WASPS—E. G. Reinhard—*Century* (\$2.50). Our interest in the ways of wasps seems to be without end; any number of books on the subject can find a market. This one is a very good one indeed: interestingly written in an easy, colloquial style and well illustrated.

Entomology

Science News-Letter, April 13, 1929

PRINCIPLES OF FOREST ENTOMOLOGY—S. A. Graham—*McGraw-Hill* (\$3.50). Trees are being taken more and more seriously as a crop, consequently their insect enemies must be taken more and more seriously. There are endless text and reference books on agricultural entomology but the forester has not yet been at all adequately supplied. The present compact volume goes far toward remedying this defect.

Entomology

Science News-Letter, April 13, 1929

BLUE BLOOD IN ANIMALS—H. M. Fox—*Brentano's* (\$2.50). A series of interestingly written, occasionally discursive essays in biology by a well-known English zoologist.

Biology

Science News-Letter, April 13, 1929

FARM RELIEF—Edited by Clyde L. King—*The Annals of the Am. Acad. Pol. and Soc. Sci.* (\$2 pa., \$2.50 cl.). With Congress in session for the pledged and avowed purpose of considering the agrarian problem the uproar over farm relief, loud enough hitherto, is bound to become deafening. For those who want something besides shouts to go on, this volume of *The Annals* will serve as a convenient and authoritative source-book. It consists of a collection of essays on various phases of present-day rural economics, each by a leader in his field.

Economics

Science News-Letter, April 13, 1929

THE FLIGHT OF THE SOUTHERN CROSS—C. E. Kingsford-Smith and C. T. P. Ulm—*McBride* (\$2.50). The first flight across the Pacific well deserves this account of its achievement. Nearly as interesting and thrilling as the actual story of the flight, is the description of the financing and the preparation that preceded the undertaking.

Aviation

Science News-Letter, April 13, 1929

INDUSTRIAL GEOGRAPHY—Ray Hughes Whitbeck—*American Book Company* (\$1.72). Where the various groups of the human race obtain their food, clothing and other necessities and luxuries is the subject of this text book. Chart and map help the reader to discover "why" the various countries have developed economically and industrially as they have.

Geography—Economics

Science News-Letter, April 13, 1929

THE RIM OF MYSTERY—John B. Burnham—*G. P. Putnam's Sons* (\$3.50). In search of a rare species of mountain sheep, the author of this epic of unknown Siberian Asia, accompanied by only one companion, traveled 2200 miles. The photographs and text give a vivid picture of the unconquered land where the Soviet and the United States come into territorial contact. Across the Bering Strait, the author visualizes for the future a tunnel carrying fast express trains into a new Siberia rich in herds and mining.

Geography—Biology

Science News-Letter, April 13, 1929

A CONTRIBUTION TO THE ORNITHOLOGY OF NORTHEASTERN BRAZIL—C. E. Hellmayr—*Field Museum* (\$2.50). Of interest to students of the taxonomy and distribution of birds.

Ornithology

Science News-Letter, April 13, 1929

A B C OF ADLER'S PSYCHOLOGY—Phillipe Mariet—*Greenburg* (\$1.50). Alfred Adler is one of the great leaders in the revolution in modern psychology which is called psycho-analysis. His particular brand of new psychology is called "individual psychology" and has received an exposition in this volume.

Psychology

Science News-Letter, April 13, 1929

HOWS AND WHYS OF HUMAN BEHAVIOR—G. A. Dorsey—*Harper's* (\$3.50). Why do we do so and so? Why do we get this way or that way? What should we do to be thus and so? Such are the "eternal riddles of human behavior" listed by Dr. Dorsey in his preface, and whether they are answered in the text the reader must guess. This book is an extension of Dr. Dorsey's drive to make human beings think about themselves.

Psychology

Science News-Letter, April 13, 1929

LEONARD AND SOULE EXPERIMENTS—Lydia W. Allison—*Boston Society for Psychic Research* (\$4). Most scientists, accustomed to more material phenomena, will not agree with the conclusions from the researches reported in the book. And most of them will feel that even the observations may have benefited from wishful thinking.

Psychology

Science News-Letter, April 13, 1929

NATURAL CONDUCT—Edwin Bingham Copeland—*Stanford University Press* (\$3.50). Practical ethics, the science of conduct, is here treated as an application of biological science. The book was written in the hope that the readers would be led to lead happier and more satisfactory lives.

Sociology—Biology

Science News-Letter, April 13, 1929

PRINCIPLES OF SOCIOLOGY—Rudolph M. Binder—*Prentice-Hall* (\$5). A sociology that brings skillfully into line present knowledge of psychology, anthropology, eugenics and other allied sciences. The breadth and depth of Dr. Binder's interests make for a book that is exceptionally comprehensive. His thesis is that an individual has certain physical and psychic needs; the general trend of these needs is toward making the most of the individual's capacities; and this he accomplishes through interaction with his social environment.

Sociology

Science News-Letter, April 13, 1929

Radio in the Schools

Radio-Pedagogy

J. J. TIGERT, in *Radio* (American Academy of Political and Social Science, Philadelphia):

Virtually every college which has a broadcasting station considers its expenditure warranted. The budgets range from \$25 to \$12,000 a year. In the former case, however, the money from the college fund is supplemented by Chamber of Commerce donations. Usually the budgets appear pitifully small.

A number of prominent universities and colleges have broadcast their programs over borrowed commercial stations. This, however, has not always proved satisfactory, because the commercial stations themselves are sometimes so limited by the Radio Commission as to find it necessary to discontinue lending time.

One handicap which the educational station must consider, and which does not admit of easy solution, is that of the daylight broadcast. As the result of the study of the programs of twenty-seven leading broadcasting stations of the country Mr. George H. Zehmer, director of extension of the University of Virginia, announced before the last meeting of the National University Extension Association:

"It seems to be pretty generally conceded that the best radio hours for general educational programs are from around seven o'clock to nine or ten o'clock in the evening. A study of the programs submitted indicates that in many instances the value of these hours for purposes of education are largely disregarded in planning programs. The hours assigned advertising generally are the most desirable periods of the radio day. The educational talks which were given in the evenings during the periods indicated were obviously sandwiched in between most of the programs which were devoted to advertising."

The experiment in radio instruction in the public schools of Oakland, California, yields most interesting and valuable information for the subject in hand.

About ten of the Oakland schools had radio sets installed for the project, two of the schools having a complete system of radio connected with all of the rooms.

The purpose, according to Mr. Virgil E. Dickson, director of the experiment, was

"To see if we could develop actual classroom instruction in which pupils

in widely distributed centers of the city would participate. . . . To develop demonstration lessons for teachers to observe children in directed activities as nearly as possible parallel to regular classroom procedure. We wanted to know if anything approaching a common classroom lesson could be sent over the air to many classes at once."

As early as May, 1924, the committee began planning the work. The subjects selected for the first series of eight demonstration lessons of twenty minutes each were English, counseling of classes going into high school, geography, literature, history, arithmetic, penmanship and physical training.

A member of the committee visited each schoolroom where students were participating in the lesson, to make observations. After each lesson, the committee compared notes and made efforts to improve the next unit of the experiment.

The first trials were considered successful, and the work was continued in the fall, when a series of fifty-six lessons, covering vocational counseling, how to read a book, drawing, penmanship, science, singing, thrift, composition, arithmetic and manual activities were broadcast, and careful tabulation made of results. Each lesson was adapted for a particular grade, ranging from the fifth to the tenth.

It is perfectly possible to get reception so that a class of any reasonable size can hear every word and every direction of the instructor who is broadcasting. Mr. Dickson reports. It is also possible, he says, to plan a lesson that will interest, and keep active, any number of classes that have been properly prepared for its reception. The experiment proved that certain lessons taught before the microphone produce class and individual results that cannot be distinguished from those gained by the same instructor teaching in person before the class.

The replies to a recent questionnaire to educators in large school systems indicate that music appreciation and current events are popularly believed to be about the only subjects which are readily adapted to radio teaching. The Oakland experiment, however, shows, unexpectedly enough, that art and arithmetic are among the subjects which lend themselves most readily

to successful treatment in radio lessons. These facts lead one irresistibly to the conclusions that radio instruction has not even begun to develop, and that subjects will not be restricted to the narrow fields which have generally been considered necessary.

Here, then, is the answer to those who maintain that formal education in the grades cannot be had by radio. Experiments such as the foregoing are bound to be supplemented in other parts of the country. The great difficulty to date has been that no one has given attention, first, to the scientific development of the lessons, and second, to the definite checking of results. It has been practically impossible to say whether formal education could be successful by radio, largely because most of the efforts at instruction have been purely informal. There seems to be no reason why radio instruction, too, should not be based on the "self-activity" necessary to the education of youth.

Benton High School at St. Joseph, Missouri, is equipped with apparatus under direct control of the principal. The central set is in the office of the principal, with a fifteen-inch loud speaker connection in each room. A microphone permits him to make announcements, and the teacher can reply by means of the loud speaker, which also acts as a microphone. There is a victrola attachment for playing records, which may be broadcast to any room at will.

The central set is tuned in at the principal's office, and at the proper moment, by the turn of a switch, all rooms are cut in on the program, with perfect reception for small groups, under teacher control, and with no loss of time.

At present, most high schools are not equipped with receiving sets because there is little material being broadcast during school hours which can be used to supplement the regular curriculum. School men state that when the college and university stations supply work of use to them, they will install radio receiving sets. However, until schools install the receiving sets and make it possible, universities and colleges probably cannot afford to put on an elaborate experimental educational program. The public schools and universities must get together on a cooperative plan for satisfactory experimental work.

Science News-Letter, April 13, 1929